

AMENDMENTS TO THE SPECIFICATION

IN THE TITLE:

Please amend the title as set forth below:

~~OPTICAL PICKUP DEVICE AND OPTICAL DISC DEVICE~~

OPTICAL PICKUP DEVICE AND OPTICAL DISK DEVICE HAVING A
DIFFRACTION GRATING

IN THE SPECIFICATION:

Please amend the specification as set forth below:

On Page 1, the paragraph beginning at line 20:

b¹ Referring to FIG. 1 of the accompanying drawings, an optical pickup device adapted to read information signals from both "CDs" and "DVDs" comprises a laser diode (LD) 101 operating as light source. The laser beam emitted from the laser diode 101 is typically red light (e.g., having a wavelength of 635nm) and fed to a beam splitter 103 by way of a diffraction grating 102. The diffraction grating 102 is used to generate a sub-beam for detecting a tracking error signal. The beam splitter 103 is a plate having a pair of parallel surface planes that are inclined by 45° relative to the optical axis of the laser beam coming from the laser diode 101. The laser beam emitted from the laser diode 101 is reflected and deflected by 90° by the corresponding surface plane of the beam splitter 103 before it is collimated by a collimator lens 104 and enters an objective lens 105. The objective lens 105 ~~focusses~~focuses the incident laser beam on the signal recording surface of a "DVD" 106a or a "CD" 106b.

On Page 2, the paragraph beginning at line 13:

b² The laser beam ~~focussed~~focused on the signal recording surface of either the "DVD" 106a or the "CD" 106b is modulated according to the information signal recorded on the "DVD" 106a or the "CD" 106b, whichever appropriate" and reflected so that it returns to the objective lens 105 as reflected laser beam. The reflected laser beam then gets to the beam splitter 103 by way of the collimator lens 104. As the reflected laser beam is transmitted through the beam splitter 103, it gives rise to astigmatism and is subsequently ~~focussed~~focused on the light

b2 receiving surface of a photodetector (PD) 107. A ~~focussing~~focusing error signal, if any, can be detected on the basis of the astigmatism generated as a result of being transmitted through the beam splitter 103.

On Page 3, the paragraph beginning at line 17:

b3 The laser beam emitted from the laser diode 101 is fed to a beam splitter 103. The beam splitter 103 is a plate having a pair of parallel surface planes that are inclined by 45° relative to the optical axis of the laser beam coming from the laser diode 101. The laser beam emitted from the laser diode 101 is reflected and deflected by 90° by the corresponding surface plane of the beam splitter 103 before it is collimated by a dichroic beam splitter 108 and a collimator lens 104, and enters an objective lens 105. The objective lens 105 ~~focusses~~focuses the incident laser beam on the signal recording surface of a "DVD" 106a.

On Page 4, the paragraph beginning at line 5:

b4 On the other hand, the laser beam emitted from the laser chip comprising the light receiving/light emitting composite element 109 is fed to a dichroic beam splitter 108. The dichroic beam splitter 108 has a reflection plane that is inclined by 45° relative to the optical axis of the laser beam coming from the laser chip comprising the light receiving/light emitting composite element 109. The laser beam emitted from the laser chip is reflected and deflected by 90° by the reflection plane. The laser beam emitted from the laser chip comprising the light receiving/light emitting composite element 109 and the laser beam emitted from the laser diode 101 are made to have a same and identical optical axis. The laser beam emitted from the laser chip comprising the light receiving/light emitting composite element 109 is then collimated by the collimator lens 104 and enters the objective lens 105. The objective lens 105 ~~focusses~~focuses the incident laser beam on the signal recording surface of a "CD" 106b.

On Page 4, the paragraph beginning at line 19:

b5 The laser beam ~~focussed~~focused on the signal recording surface of either the "DVD" 106a or the "CD" 106b is then reflected by the signal recording surface thereof so that it returns to the objective lens 105 as reflected laser beam. The reflected laser beam then gets to the

B5 collimator lens 104 and the dichroic beam splitter 108. Since the dichroic beam splitter 108 transmits red light but reflects infrared beams, the optical path of the red beam and that of the infrared laser beam are separated from each other there.

On Page 5, the paragraph beginning at line 5:

B6 The red beam transmitted through the dichroic beam splitter 108 then gets to the beam splitter 103 and, as it is transmitted through the beam splitter 103, it gives rise to astigmatism and is subsequently ~~focussed~~focused on the light receiving surface of a photodetector (PD) 107.

On Page 5, the paragraph beginning at line 9:

B7 On the other hand, the infrared beam reflected by the reflection plane of the dichroic beam splitter 108 is ~~focussed~~focused on the light receiving surface of the photodetector of the light receiving/light emitting composite element 109.

On Page 6, the paragraph beginning at line 3:

B8 Referring now to FIG. 4, with the optical pickup device that is adapted to read information signals from both a "CD" and a "DVD" by using a monolithic laser diode, the laser beams emitted from the laser chips 111a, 111b of the light receiving/light emitting composite element 110 are fed to the objective lens 105 by way of the collimator lens 104 so as to be ~~focussed~~focused on the signal recording surface of the "DVD" 106a or the "CD" 106b by the objective lens 105. Then, the laser beam reflected by the signal recording surface of the "DVD" 106a or the "CD" 106b, whichever appropriate, is fed back to the light receiving/light emitting composite element 110 and received by the photodetector of the light receiving/light emitting composite element 110.

On Page 8, the paragraph beginning at line 8:

B9 It is also possible to form an optical system, using a monolithic diode in a discrete way as shown in FIG. 5. The laser diode 101a of the optical pickup device of FIG. 5 comprises first and second laser chips 111a, 111b as shown in FIG. 6. The laser beams emitted from the laser diode 101a typically include a red laser beam and an infrared laser beam that are fed to a beam splitter

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103 by way of a diffraction grating 102. The diffraction grating 102 is used to generate a sub-beam for detecting a tracking error signal. The beam splitter 103 is a plate having a pair of parallel surface planes that are inclined by 45° relative to the optical axis of the laser beam coming from the laser diode 101a. The laser beam emitted from the laser diode 101a is reflected and deflected by 90° by the corresponding surface plane of the beam splitter 103 before it is collimated by a collimator lens 104 and enters an objective lens 105. The objective lens 105 ~~focusses~~focuses the incident laser beam on the signal recording surface of a "DVD" 106a or a "CD" 106b.

On Page 8, the paragraph beginning at line 20:

B10
The laser beam ~~focussed~~focused on the signal recording surface of either the "DVD" 106a or the "CD" 106b is modulated according to the information signal recorded on the "DVD" 106a or the "CD" 106b, whichever appropriate and reflected so that it returns to the objective lens 105 as reflected laser beam. The reflected laser beam then gets to the beam splitter 103 by way of the collimator lens 104. As the reflected laser beam is transmitted through the beam splitter 103, it gives rise to astigmatism and is subsequently ~~focussed~~focused on the light receiving surface of a photodetector (PD) 107. A ~~focussing~~focusing error signal, if any, can be detected on the basis of the astigmatism generated as a result of being transmitted through the beam splitter 103.

On Page 9, the paragraph beginning at line 17:

B11
With any of the above described optical pickup devices comprising a pair of light emitting spots, the two light emitting spots are separated from each other at least by a distance of about 80 μm in view of the spatial restrictions imposed on it. Thus, in the case of a confocal optical system, two focal points are formed on the respective light receiving surfaces of the photodetector and separated from each other by a distance of about 80 μm. Therefore, a pair of light receiving surfaces are arranged in the photodetector and separated from each other by at least about 80 μm in order to receive the two laser beams that are ~~focussed~~focused to the respective focal points.

On Page 11, the paragraph beginning at line 13:

b12
an objective lens for ~~focussing~~focusing said light beam or said second light beam to the signal recording surface of an an optical of a first type matching to the first wavelength or that of an an optical of a second type matching to the second wavelength, whichever appropriate;

On Page 11, the paragraph beginning at line 17:

b13
a photodetector for detecting the light beam ~~focussed~~focused on the signal recording surface of the an optical of the first type or that of the an optical of the second type, whichever appropriate, by the objective lens and reflected by the signal recording surface; and

On Page 12, the paragraph beginning at line 2:

b14
at least either the first light beam adapted to be used for reading information signals from the signal recording surface of the an optical of the first type and reflected by the reflecting surface or the second light beam adapted to be used for reading information signals from the signal recording surface of the an optical of the second type and reflected by the reflecting surface being diffracted by the diffraction element, the first reflected light beam and the second reflected light beam being ~~focussed~~focused to a same spot on the light receiving surface of the photodetector.

On Page 13, the paragraph beginning at line 19:

b15
As pointed out above, in an optical pickup device according to the invention, either the first light beam adapted to be used for reading information signals from the signal recording surface of the recording medium of the first type and reflected by the reflecting surface or the second light beam adapted to be used for reading information signals from the signal recording surface of the optical recording medium of the second type and reflected by the reflecting surface is diffracted by the diffraction element and the first reflected light beam and the second reflected light beam are ~~focussed~~focused to a same spot on the light receiving surface of the photodetector.

On Page 19, the paragraph beginning at line 6:

B14
The light beam emitted from the laser diode 1 gets to a beam splitter 3 by way of a diffraction grating 2. The diffraction grating 2 is used to generate a pair of sub-beams to be used for detecting a tracking error signal. The beam splitter 3 is a plate having a pair of parallel surface planes that are inclined by 45° relative to the optical axis of the laser beam coming from the laser diode 1. The laser beam emitted from the laser diode 1 is reflected and deflected by 90° by the corresponding surface plane of the beam splitter 3 before it is collimated by a collimator lens 4 and enters an objective lens 5. The objective lens 5 ~~foeusses~~focuses the incident laser beam on the signal recording surface of a "DVD" 106a or a "CD" 106b.

On Page 19, the paragraph beginning at line 16:

B17
The laser beam ~~foeussed~~focused on the signal recording surface of either the "DVD" 106a or the "CD" 106b is modulated according to the information signal recorded on the "DVD" 106a or the "CD" 106b, whichever appropriate" and reflected so that it returns to the objective lens 5 as reflected laser beam.

On Page 20, the paragraph beginning at line 13:

B18
Both the diffracted light beam of the 1st degree of the first reflected light beam produced by the diffraction element 6 and that of the second reflected light beam produced by the diffraction element 6 are then ~~foeussed~~focused to the focal point on the light receiving section 7a of the photodetector 7. With this optical pickup device, it should be reiterated that both the diffracted light beam of the 1st degree of the first reflected light beam and that of the second reflected light beam are ~~foeussed~~focused to a same focal point on a same light receiving section 7a. Both the diffracted light beam of the 1st degree of the first reflected light beam and that of the second reflected light beam are ~~foeussed~~focused to a same focal point on a same light receiving section 7a because the distance separating the focal points of the two light beams that corresponds to the distance separating the two light emitting spots of the laser diode 1 is offset by the difference in the diffraction angle of the two reflected light beams.

On Page 21, the paragraph beginning at line 10:

B19
The photodetector 7 is adapted to detect a ~~focussing~~focusing error signal, if any, on the basis of the astigmatism produced when the light beam is transmitted through the beam splitter 3. The pair of sub-beams generated by the diffraction grating 2 also gets to the photodetector 7 by way of the above described light path. A ~~focussing~~focusing error signal can be detected by the photodetector 7 by detecting the reflected light beams of the sub-beams. More specifically, as shown in FIG. 11, the photodetector 7 comprises a main light receiving section 7a and a pair of auxiliary light receiving sections 7b, 7c for receiving the reflected light beams of the sub-beams. The main light receiving section 7a is divided into four light receiving areas that are arranged radially as viewed from the center thereof so that the photodetection output of each of the light receiving areas can be obtained independently. Then, a ~~focussing~~focusing error signal can be obtained by means of a so-called astigmatism method of performing arithmetic operations using the photodetection outputs of the light receiving areas. On the other hand, each of the paired auxiliary light receiving sections 7b, 7c has a single light receiving area and they can obtain their respective photodetection outputs independently. A tracking error signal, if any, can be detected by the photodetector 7 by means of a so-called 3-beam method of performing arithmetic operations using the photodetection outputs of the auxiliary light receiving sections 7b, 7c.

On Page 29, the paragraph beginning at line 14:

B20
FIG. 18 is a schematic lateral view of the optical system of still another embodiment of optical pickup device according to the invention, comprising a two-wavelength type monolithic laser diode and a diffraction element 6 arranged on the backward light path so that the light beam for a "DVD" and the light beam for a "CD" may be ~~focussed~~focused on a same spot on a light receiving surface by using the diffracted light beams from the diffraction element 6. As shown in FIG. 19, the diffraction element 6 is a blazed diffraction grating adapted to raise the intensity of the diffracted laser beam of a specific degree.

On Page 30, the paragraph beginning at line 7:

B21
With the optical system of this embodiment of optical pickup device, the diffracted light beam of the 0-th degree obtained from the diffraction element 6 for the light beam emitted from

B21
one of the laser chips of the laser diode 1 is used for a "DVD", while the diffracted light beam of the 1st degree obtained from the diffraction element 6 for the light beam emitted from the other laser chip of the laser diode 1 is used for a "CD". Then, both the light beam for a "DVD" and the light beam for a "CD" are ~~foeussed~~focused to a same focal point on the light receiving section 7a of the photodetector 7.

On Page 31, the paragraph beginning at line 18:

B22
This optical system is advantageous relative to the optical system where the diffraction element 6 is arranged on the backward light pass from the optical discs in that it is more free from mutual displacement of the focal points and the two light beams can be ~~foeussed~~focused accurately to a same spot on the light receiving section of the photodetector to improve the performance of the optical pickup device.

On Page 32, the paragraph beginning at line 9:

B23
When the light receiving section of the photodetector is shared by the "DVD" and the "CD" while the light receiving section is divided into four light receiving areas that are arranged radially as viewed from the center thereof so that a so-called astigmatism method is used for detecting a ~~foeussing~~focusing error signal and/or a so-called DPD method is used for detecting a tracking error signal, care should be taken about a number of possible phenomena including that the efficiency of utilization of light can be reduced due to an excessive low diffraction efficiency of the diffraction element, that the degree of freedom for regulating the optical system can be reduced due to an excessive small diffraction angle, that the optical system can show a degraded resistance to temperature changes due to the temperature dependency of the performance of the diffraction element and that the optical performance of the optical system can become degraded as a result of an inclined optical axis.